

PATENT APPLICATION
Theodore Robert Whitney

Appendix 1

Other References Cited

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2. U. S. Patent 3,748,015, Abe Offner, dated July 24, 1973, *"Unit Power Imaging Catoptric Anastigmat"*
3. U. S. Patent 3,821,763, Roderic M. Scott, dated June 28, 1974, *"Annular Field Optical Imaging System"*
4. U. S. Patent 3,884,573, David M. Franklin, dated May 20, 1975, *"Apparatus for High Resolution Projection Printing"*
5. U. S. Patent 3,951,546, David A. Markle, dated April 20, 1976, *"Three-Fold Mirror Assembly for a Scanning Projection System"*
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9. U. S. Patent 4,171,870, John H. Bruning et al, dated Oct. 23, 1979, *"Compact Image Projection Apparatus"*
10. U. S. Patent 4,241,390, David A. Markle, dated Dec. 23, 1980, *"System for Illuminating an Annular Field"*
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12. U. S. Patent 4,650,315, David A. Markle, dated Mar. 17, 1987, *"Optical Lithographic System"*
13. U. S. Patent 4,779,966, Irwin Friedman, dated Oct. 25, 1988, *"Single Mirror Projection Optical System"*
14. U. S. Patent 4,924,257, Kantilal Jain, dated May 8, 1990, *"Scan and Repeat High Resolution Projection Lithography System"*
15. U. S. Patent 4,933,714, Jere D. Buckley et al, dated June 12, 1990, *"Apparatus and Method for Reproducing a Pattern in an Annular Area"*
16. U. S. Patent 4,953,388, Andrew H. Barada, dated Sept. 14, 1990, *"Air Gauge Sensor"*

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17. U. S. Patent 5,103,257, Rolof Wijnasendts-van-Resandt, dated April 7, 1992, "*Process for Producing or Inspecting Micropatterns on Large-Area Substrates*"
18. U. S. Patent 5,227,839, Paul C. Allen, dated July 13, 1993, "*Small Field Scanner*"
19. U. S. Patent 5,285,236, Kanti Jain, dated Feb. 8, 1994, "*Large-Area High-Throughput, High-Resolution Projection Imaging System*"
20. U. S. Patent 5,329,332, David A. Markle et al, dated July 12, 1994, "*System for Achieving a Parallel Relationship Between Surfaces of Wafer and Reticle or Half-Field Dyson Stepper*"
21. "A Large Flat Panel Printer", T. R. Whitney, presented to the Society for Imaging Science and Technology 49th Annual Conference May 19-24, 1996
22. U. S. Patent 5,530,516, Ronald E. Sheets, dated June 25, 1996, "*Large-Area Projection Exposure System*"
23. U. S. Patent 5,559,629, Ronald E. Sheets et al, dated Sept. 24, 1996, "*Unit Magnification Projection System and Method*"
24. U. S. Patent 5,585,972, David A. Markle, dated Dec. 17, 1996, "*Arbitrarily Wide Lens Array with an Image Field to Span the Width of a Substrate*"
25. U. S. Patent 5,652,645, Kanti Jain, dated July 29, 1997, "*High-Throughput, High-Resolution, Projection Patterning System for Large, Flexible Roll-Fed, Electronic-Module Substrates*"
26. U. S. Patent 5,710,619, Kanti Jain, dated Jan. 20, 1998, "*Large-Area, Scan-and-Repeat, Projection Patterning System with Unitary Stage and Magnification Control Capability*"
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28. U. S. Patent 5,739,964, Paul C. Allen, dated April 14, 1998, "*Magnification Correction for Small Field Scanning*"
29. U. S. Patent 5,781,346, Paul C. Allen et al, dated July 14, 1998, "*Magnification Correction for Small Field Scanning*"
30. U. S. Patent 6,018,383, Thomas J. Dunn et al, dated Jan. 25, 2000, "*Very Large Area Patterning System for Flexible Substrates*"
31. U. S. Patent 6,084,706, John M. Tamkin et al, dated July 4, 2000, "*High Efficiency Pattern Generator*"
32. U. S. Patent 6,304,315 B2, David Kessler et al, dated Oct. 16, 2001, "*High Speed High Resolution Continuous Optical Film Printer for Duplicating Motion Films*"

TABLE 1A

RLE
 ID ALL MIRROR SYSTEM, 1X1REFLECT.006
 ID1 F/NUM 3.449, COMPLETELY OFFNER SYSTEM
 ID2 ALL SPHERES
 ID3 ABOUT 18 INCHES BETWEEN FIELD CENTER LINES
 ID4 ARCTUATE FIELD INSTALLED AS UAP 4,
 ID5 122.29 MM. ARC RADIUS. FIELD WIDTH 1X30 MM.
 WAVL .3650000 .4040000 .4380000
 APS -22
 GLOBAL
 XPXT
 UNITS MM
 OBJ FINITE -0.24140259 4.00000000 15.00000000
 REF HEIGHT -0.03500000 4.00003140 -0.03500000 15.00011774
 MARGIN 1.270000
 BEVEL 0.254001
 0 AIR
 1 CV 0.000000000000 TH 0.00000000
 1 -AIR
 2 UAP 4 8
 15.00000000 -0.54000000
 8.00000000 0.54000000
 -8.00000000 0.54000000
 -15.00000000 -0.54000000
 -15.00000000 -1.54000000
 -8.00000000 -0.54000000
 8.00000000 -0.54000000
 15.00000000 -1.54000000
 2 CV 0.000000000000 TH 0.00000000
 2 -AIR
 3 CV 0.000000000000 TH -80.00000000
 3 -AIR
 4 CV 0.000000000000 TH 0.00000000
 4 -AIR
 5 CV 0.000000000000 TH -59.90240000
 5 -AIR
 6 RAO 120.00000000 60.00000000 -10.00000000 0.00000000
 6 CV 0.000000000000 TH 0.00000000
 6 AIR
 6 DECEN 0.00000000 0.00000000 0.00000000 200
 6 BT 45.00000092 0.00000000 200
 6 EFILE EX1 31.270000 31.270000 31.524000 0.000000
 6 EFILE EX2 31.270000 31.270000 0.000000
 6 EFILE MIRROR -10.000000
 7 CV 0.000000000000 TH 0.00000000
 7 AIR
 7 DECEN 0.00000000 0.00000000 0.00000000 200
 7 BT 45.00000092 0.00000000 200
 8 CV 0.000000000000 TH 0.00000000
 8 AIR
 9 CV 0.000000000000 TH 0.00000000
 9 AIR
 10 CV 0.000000000000 TH 122.29000000
 10 AIR
 10 DECEN 0.00000000 0.00000000 0.00000000 99
 10 AT 0.00000000 0.00000000 99
 11 RAO 120.00000000 120.00000000 0.00000000 -8.00000000
 11 CV 0.000000000000 TH 0.00000000
 11 -AIR
 11 DECEN 0.00000000 0.00000000 0.00000000 200
 11 AT 45.00000107 0.00000000 200
 11 EFILE EX1 61.270000 61.270000 61.524000 0.000000
 11 EFILE EX2 61.270000 61.270000 0.000000
 11 EFILE MIRROR 12.500000
 12 CV 0.000000000000 TH -442.33584756
 12 -AIR
 12 DECEN 0.00000000 0.00000000 0.00000000 200
 12 AT 45.00000107 0.00000000 200
 13 RAO 240.00000000 218.00000000 0.00000000 108.00000000
 13 CV 0.0014062460552 TH 351.39880915

13 AIR
 13 DECEN 0.00000000 -108.00000000 0.00000000 200
 13 AT 0.00000000 0.00000000 200
 13 EFILE EX1 110.270000 110.270000 110.270000 0.000000
 13 EFILE EX2 110.270000 110.270000 0.000000
 13 EFILE MIRROR -10.900000
 14 CV 0.000000000000 TH 0.00000000
 14 AIR
 15 CV 0.000000000000 TH 0.00000000
 15 AIR
 16 CV 0.000000000000 TH 0.00000000
 16 AIR
 17 CV 0.000000000000 TH 0.00000000
 17 AIR
 18 CV 0.000000000000 TH 0.00000000
 18 AIR
 19 CV 0.000000000000 TH 0.00000000
 19 AIR
 20 CV 0.000000000000 TH 0.00000000
 20 AIR
 20 DECEN 0.00000000 0.00000000 0.00000000 1
 20 GT 90.00000000 0.00000000 1
 21 CV 0.000000000000 TH 0.00000000
 21 AIR
 22 RAD 356.1697137266146 TH 0.00000000
 22 -AIR
 22 DC1 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00
 22 DC2 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
 22 DC3 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
 22 DECEN 0.00000000 0.00000000 0.00000000 99
 22 AT 0.00000000 0.00000000 99
 22 EFILE EX1 49.000000 50.000000 50.000000 0.000000
 22 EFILE EX2 49.000000 49.000000 0.000000
 22 EFILE MIRROR 12.500000
 23 CV 0.000000000000 TH 0.00000000
 23 -AIR
 23 DECEN 0.00000000 0.00000000 0.00000000 1
 23 AT 0.00000000 0.00000000 1
 24 CV 0.000000000000 TH 0.00000000
 24 -AIR
 25 CV 0.000000000000 TH 0.00000000
 25 -AIR
 26 CV 0.000000000000 TH 0.00000000
 26 -AIR
 27 CV 0.000000000000 TH 0.00000000
 27 -AIR
 28 PTH -21 1.00000000 0.00000000
 28 CV 0.000000000000
 28 -AIR
 29 PCV 21 1.00000000 0.00000000
 29 PTH -20 1.00000000 0.00000000
 29 PIN -20
 29 GID 'PICKUP '
 30 PCV 20 1.00000000 0.00000000
 30 PTH -19 1.00000000 0.00000000
 30 -AIR
 31 PCV 19 1.00000000 0.00000000
 31 PTH -18 1.00000000 0.00000000
 31 PIN -18
 31 GID 'PICKUP '
 32 PCV 18 1.00000000 0.00000000
 32 PTH -17 1.00000000 0.00000000
 32 -AIR
 33 PCV 17 1.00000000 0.00000000
 33 PTH -16 1.00000000 0.00000000
 33 PIN -16
 33 GID 'PICKUP '
 34 PCV 16 1.00000000 0.00000000
 34 PTH -15 1.00000000 0.00000000
 34 -AIR
 35 PCV 15 1.00000000 0.00000000
 35 PTH -14 1.00000000 0.00000000

TABLE 1B

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35 PIN -14
35 GID 'PICKUP '
36 PCV 14 1.00000000 0.00000000
36 PTH -13 1.00000000 0.00000000
36 -AIR
37 PCV 13 1.00000000 0.00000000
37 RAO 240.00000000 218.00000000 0.00000000 -108.00000000
37 TH 462.33584756
37 AIR
37 EFILE EX1 110.270000 110.270000 110.524001 0.000000
37 EFILE EX2 110.270000 110.270000 0.000000
37 EFILE MIRROR -10.900000
38 RAO 120.00000000 120.00000000 0.00000000 8.00000000
38 CV 0.000000000000 TH 0.00000000
38 -AIR
38 DECEN 0.00000000 -108.00000000 0.00000000 200
38 AT 45.00000106 0.00000000 200
38 EFILE EX1 61.270000 61.270000 61.524000 0.000000
38 EFILE EX2 61.270000 61.270000 0.000000
38 EFILE MIRROR 12.500000
39 CV 0.000000000000 TH 0.00000000
39 -AIR
39 DECEN 0.00000000 0.00000000 0.00000000 200
39 AT 45.00000106 0.00000000 200
40 CV 0.000000000000 TH 0.00000000
40 -AIR
41 CV 0.000000000000 TH -122.29000000
41 -AIR
42 RAO 120.00000000 60.00000000 -10.00000000 0.00000000
42 CV 0.000000000000 TH 0.00000000
42 AIR
42 DECEN 0.00000000 0.00000000 0.00000000 200
42 BT -45.00000092 0.00000000 200
42 EFILE EX1 31.270000 31.270000 31.524000 0.000000
42 EFILE EX2 31.270000 31.270000 0.000000
42 EFILE MIRROR -10.000000
43 CV 0.000000000000 TH 59.90240000
43 AIR
43 DECEN 0.00000000 0.00000000 0.00000000 200
43 BT -45.00000092 0.00000000 200
44 CV 0.000000000000 TH 0.00000000
44 AIR
45 CV 0.000000000000 TH 0.00000000
45 AIR
46 CV 0.000000000000 TH 0.00000000
46 AIR
47 CV 0.000000000000 TH 0.00000000
47 AIR
48 CV 0.000000000000 TH 80.00000000
48 AIR
49 CV 0.000000000000 TH 0.24140259
49 AIR
50 CV 0.000000000000 TH 0.00000000
50 AIR
51 CV 0.000000000000 TH 0.00000000
51 AIR
END
SYNOPSIS AI>

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TABLE 1C

ID PRP 20 VERSION 1.8 USING ASPHERIC
 ID1 F/NUM 4.05 BY 4.85, FROM VERSION 1.7
 ID2 ASPHERIC PUPIL, ARC FIELD STOP FEATHERED
 ID3 ABOUT 19.3 INCHES BETWEEN FIELD CENTER LINES
 ID4 122.0 MM. ARC RADIUS. FIELD WIDTH 4X80 MM.
 WAVL .3650000 .4040000 .4380000
 APS -21
 GLOBAL
 XPXT
 EPUPIL
 NOVIG
 UNITS MM
 OBJ FINITE -0.24140259 2.00000000 40.00000000
 REF HEIGHT -0.02500000 2.00002315 -0.03000000 40.00046302
 MARGIN 1.270000
 BEVEL 0.254001
 0 AIR
 1 CAO 124.00000000 0.00000000 -122.00000000
 1 CAI 120.00000000 0.00000000 -122.00000000
 1 CV 0.000000000000 TH 0.00000000
 1 -AIR
 2 UAP 4 4
 40.10000000 2.10000000
 40.10000000 -4.70000000
 -40.10000000 -4.70000000
 -40.10000000 2.10000000
 2 CV 0.000000000000 TH -136.06343000
 2 -AIR
 3 RAO 180.00000000 60.00000000 10.00000000 0.00000000
 3 CV 0.000000000000 TH 0.00000000
 3 AIR
 3 DECEN 0.00000000 0.00000000 0.00000000 200
 3 BT -45.00000055 0.00000000 200
 3 EFILE EX1 31.270000 31.270000 31.524000 0.000000
 3 EFILE EX2 31.270000 31.270000 0.000000
 3 EFILE MIRROR -10.000000
 4 CV 0.000000000000 TH 113.83900000
 4 AIR
 4 DECEN 0.00000000 0.00000000 0.00000000 200
 4 BT -45.00000055 0.00000000 200
 5 RAO 155.00010000 95.00000000 0.00000000 -5.00000000
 5 CV 0.000000000000 TH 0.00000000
 5 -AIR
 5 DECEN 0.00000000 0.00000000 0.00000000 200
 5 AT 45.00000161 0.00000000 200
 5 EFILE EX1 48.770000 48.770000 49.024000 0.000000
 5 EFILE EX2 48.770000 48.770000 0.000000
 5 EFILE MIRROR 10.000000
 6 CV 0.000000000000 TH 0.00000000
 6 -AIR
 6 DECEN 0.00000000 0.00000000 0.00000000 200
 6 AT 45.00000161 0.00000000 200
 7 CV 0.000000000000 TH 0.00000000
 7 -AIR
 8 CV 0.000000000000 TH 0.00000000
 8 -AIR
 9 CV 0.000000000000 TH -96.27020000
 9 -AIR
 10 RAO 190.00020000 130.00000000 0.00000000 -5.00000000
 10 CV 0.000000000000 TH 0.00000000
 10 AIR
 10 DECEN 0.00000000 0.00000000 0.00000000 200
 10 AT -45.00000176 0.00000000 200
 10 EFILE EX1 66.270000 66.270000 66.524000 0.000000
 10 EFILE EX2 66.270000 66.270000 0.000000
 10 EFILE MIRROR -10.000000
 11 CV 0.000000000000 TH 340.18700000
 11 AIR
 11 DECEN 0.00000000 0.00000000 0.00000000 200

11 AT -45.00000176 0.00000000 200
 12 RAO 255.00000000 170.00000000 0.00000000 122.00000000
 12 CV -0.0014660357817 TH -335.38433884
 12 -AIR
 12 DECEN 0.00000000 -122.00000000 0.00000000 200
 12 AT 0.00000000 0.00000000 200
 12 EFILE EX1 86.270000 86.270000 86.524001 0.000000
 12 EFILE EX2 86.270000 86.270000 0.000000
 12 EFILE MIRROR 8.500000
 13 CV 0.00000000000000 TH 0.00000000
 13 -AIR
 14 CV 0.00000000000000 TH 0.00000000
 14 -AIR
 15 CV 0.00000000000000 TH 0.00000000
 15 -AIR
 16 CV 0.00000000000000 TH 0.00000000
 16 -AIR
 17 CV 0.00000000000000 TH 0.00000000
 17 -AIR
 18 CV 0.00000000000000 TH 0.00000000
 18 -AIR
 19 CV 0.00000000000000 TH 0.00000000
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 19 DECEN 0.00000000 0.00000000 0.00000000 1
 19 GT -90.00000086 0.00000000 1
 20 CV 0.00000000000000 TH 0.00000000
 20 -AIR
 21 RAD -384.3771101406386 TH 0.00000000
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 21 AIR
 21 DC1 -1.6015744E-04-3.0107985E-09-3.9049472E-14 1.4301874E-17-2.6293285E-21
 21 DC2 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
 21 DC3 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
 21 DECEN 0.00000000 0.00000000 0.00000000 99
 21 AT 0.00000000 0.00000000 99
 21 EFILE EX1 49.000000 50.000000 50.000000 0.000000
 21 EFILE EX2 49.000000 49.000000 0.000000
 21 EFILE MIRROR -12.500000
 22 CV 0.00000000000000 TH 0.00000000
 22 AIR
 22 DECEN 0.00000000 0.00000000 0.00000000 1
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 23 CV 0.00000000000000 TH 0.00000000
 23 AIR
 24 CV 0.00000000000000 TH 0.00000000
 24 AIR
 25 CV 0.00000000000000 TH 0.00000000
 25 AIR
 26 CV 0.00000000000000 TH 0.00000000
 26 AIR
 27 PTH -20 1.00000000 0.00000000
 27 CV 0.00000000000000
 27 AIR
 28 PCV 20 1.00000000 0.00000000
 28 PTH -19 1.00000000 0.00000000
 28 PIN -19
 28 GID 'PICKUP '
 29 PCV 19 1.00000000 0.00000000
 29 PTH -18 1.00000000 0.00000000
 29 AIR
 30 PCV 18 1.00000000 0.00000000
 30 PTH -17 1.00000000 0.00000000
 30 PIN -17
 30 GID 'PICKUP '
 31 PCV 17 1.00000000 0.00000000
 31 PTH -16 1.00000000 0.00000000
 31 AIR
 32 PCV 16 1.00000000 0.00000000
 32 PTH -15 1.00000000 0.00000000
 32 PIN -15
 32 GID 'PICKUP '
 33 PCV 15 1.00000000 0.00000000

33 PTH -14 1.00000000 0.00000000
 33 AIR
 34 PCV 14 1.00000000 0.00000000
 34 PTH -13 1.00000000 0.00000000
 34 PIN -13
 34 GID 'PICKUP '
 35 PCV 13 1.00000000 0.00000000
 35 PTH -12 1.00000000 0.00000000
 35 AIR
 36 PCV 12 1.00000000 0.00000000
 36 RAO 255.00000000 170.00000000 0.00000000 -122.00000000
 36 TH -331.26900000
 36 -AIR
 36 EFILE EX1 86.270000 86.270000 86.524001 0.000000
 36 EFILE EX2 86.270000 86.270000 0.000000
 36 EFILE MIRROR 8.500000
 37 RAO 190.00020000 130.00000000 0.00000000 0.00000000
 37 CV 0.00000000000000 TH 0.00000000
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 37 AT -45.00000175 0.00000000 200
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 37 EFILE EX2 66.270000 66.270000 0.000000
 37 EFILE MIRROR -10.000000
 38 CV 0.00000000000000 TH 92.89800000
 38 AIR
 38 DECENT 0.00000000 0.00000000 0.00000000 200
 38 AT -45.00000175 0.00000000 200
 39 CV 0.00000000000000 TH 0.00000000
 39 AIR
 40 CV 0.00000000000000 TH 182.19200000
 40 AIR
 41 CV 0.00000000000000 TH 0.00000000
 41 AIR
 42 CV 0.00000000000000 TH 0.00000000
 42 AIR
 43 CV 0.00000000000000 TH 0.00000000
 43 AIR
 44 CV 0.00000000000000 TH 0.00000000
 44 AIR
 45 CV 0.00000000000000 TH 80.00000000
 45 AIR
 46 CV 0.00000000000000 TH -220.69057000
 46 AIR
 47 RAO 169.99965000 95.00000000 0.00000000 -5.00000000
 47 CV 0.00000000000000 TH 0.00000000
 47 -AIR
 47 DECENT 0.00000000 0.00000000 0.00000000 200
 47 AT -45.00000055 0.00000000 200
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 47 EFILE EX2 48.770000 48.770000 0.000000
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 48 -AIR
 48 DECENT 0.00000000 0.00000000 0.00000000 200
 48 AT -45.00000055 0.00000000 200
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 50 CV 0.00000000000000 TH 0.00000000
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 50 BT 45.00000052 0.00000000 200
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 51 BT 45.00000052 0.00000000 200
 52 CV 0.00000000000000 TH 0.00000000
 52 AIR

TABLE 2C